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SURGICAL SCRUB SINK NSN 6545-01-117-3894 MODIFICATION
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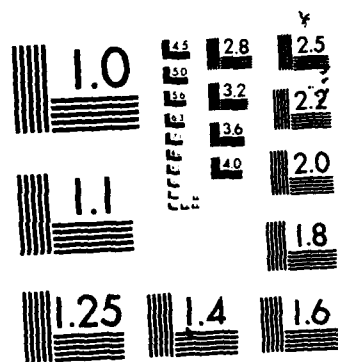
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Technical Report 8612

SURGICAL SCRUB SINK NSN 6545-01-117-3894
MODIFICATION AND EVALUATION

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The sink design was reevaluated in 1985. It was proposed that a pressure relief valve be added at the pump outlet to reduce back pressure, therefore, reducing operating temperature and component wear. This modification was tested to evaluate the concept and determine the subsequent necessity of continuing the fan modification.

The sink was operated at minimum and maximum flow rates, with and without the fan, in an environmental chamber with varied ambient temperature. It was found that a brass pressure relief valve cracking at approximately 5 lb/in² with pipe size 1/2 inch supplied the sink with enough pressure to maintain flow rates while reducing back pressure enough to allow the pump to efficiently operate and kept the pump from overheating. Additional testing showed that the extra fan was required in rooms with poor circulation. ←

It is recommended that the brass pressure relief valve with pipe size 1/2 inch and cracking pressure 5 lb/in² be installed in parallel with the knee switch and valve.

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INTRODUCTION

BACKGROUND

The Surgical Scrub Sink (NSN 6545-01-117-3894) was developed in 1967 to provide a facility for scrubbing at field hospitals. Water temperature is controlled by varying the flow rate of water through a heater.

Complaints were received over the following years, stating that the sink used too high a volume of water. A manifold with very a small inner diameter was installed at the pump outlet port to restrict flow. The sink pump produces a constant flow, so the restriction forces the pump to operate against increasingly high back pressures. Consequently, the water pump frequently overheats and requires replacement of prematurely worn components. A fan assembly was added in 1983 to aid in cooling the pump motor. This kept the pump from overheating, but premature wear on parts was still evident.

The sink design was reevaluated in 1985. Tests showed that at high flow rates the pump was working against a back pressure up to 18 lb/in^2 , while it is intended for use against pressure less than 12 lb/in^2 . It was proposed that a pressure relief valve be added at the pump outlet to reduce back pressure, therefore, reducing operating temperature and component wear.

PURPOSE

To test the proposed pressure relief valve modification and to determine subsequent necessity of continuing the fan assembly modification.

METHODS AND MATERIALS

EQUIPMENT

The surgical scrub sink was assembled in pump operation configuration (it can also be configured for gravity feed flow). The pump used in this sink was a TEEL Model 360-115V. Valves of varied sizes were tried until a pipe size of 1/2 inch was found to have sufficient capacity to reduce pressure. A cracking pressure of 5 lb/in^2 supplied the sink with enough pressure to maintain flow rates while keeping back pressure low enough for the pump to operate efficiently. A brass relief valve of a pipe size 1/2 inch and 5 lb/in^2 cracking pressure met these requirements.

The valve was connected for testing purposes at the inlet labeled GRAVITY FEED as shown in figure 1, page 4. Tubing was connected to return the excess flow to the reservoir. This configuration was intended for testing only, allowing measurements such as pressure and flow rates to be easily made. For permanent use, it is recommended that the valve be installed so that the knee valve is bypassed at high pressures. This configuration is illustrated in figure 2, page 5. This would eliminate added tubing and disruption of the efficient sink packaging.

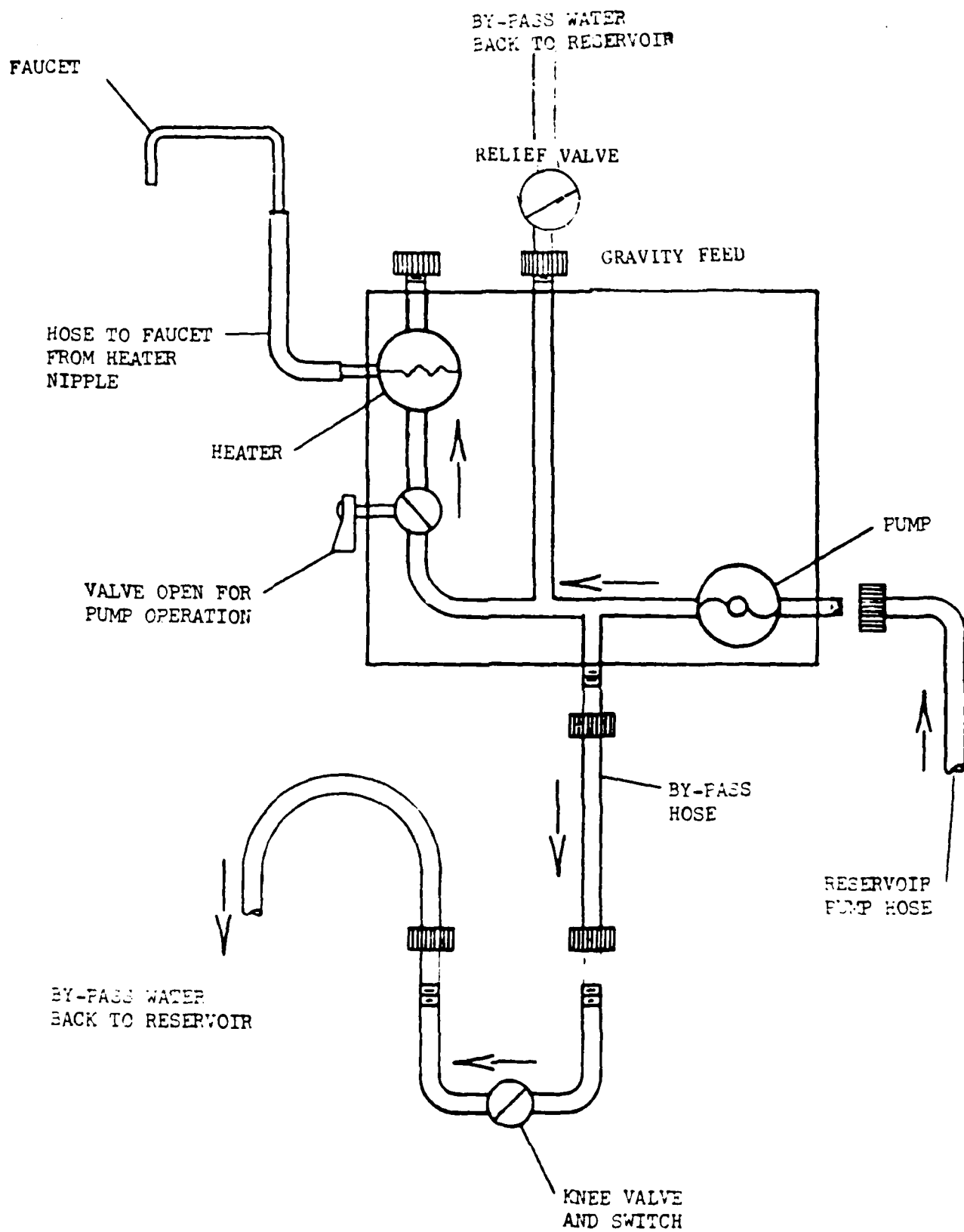


Figure 1

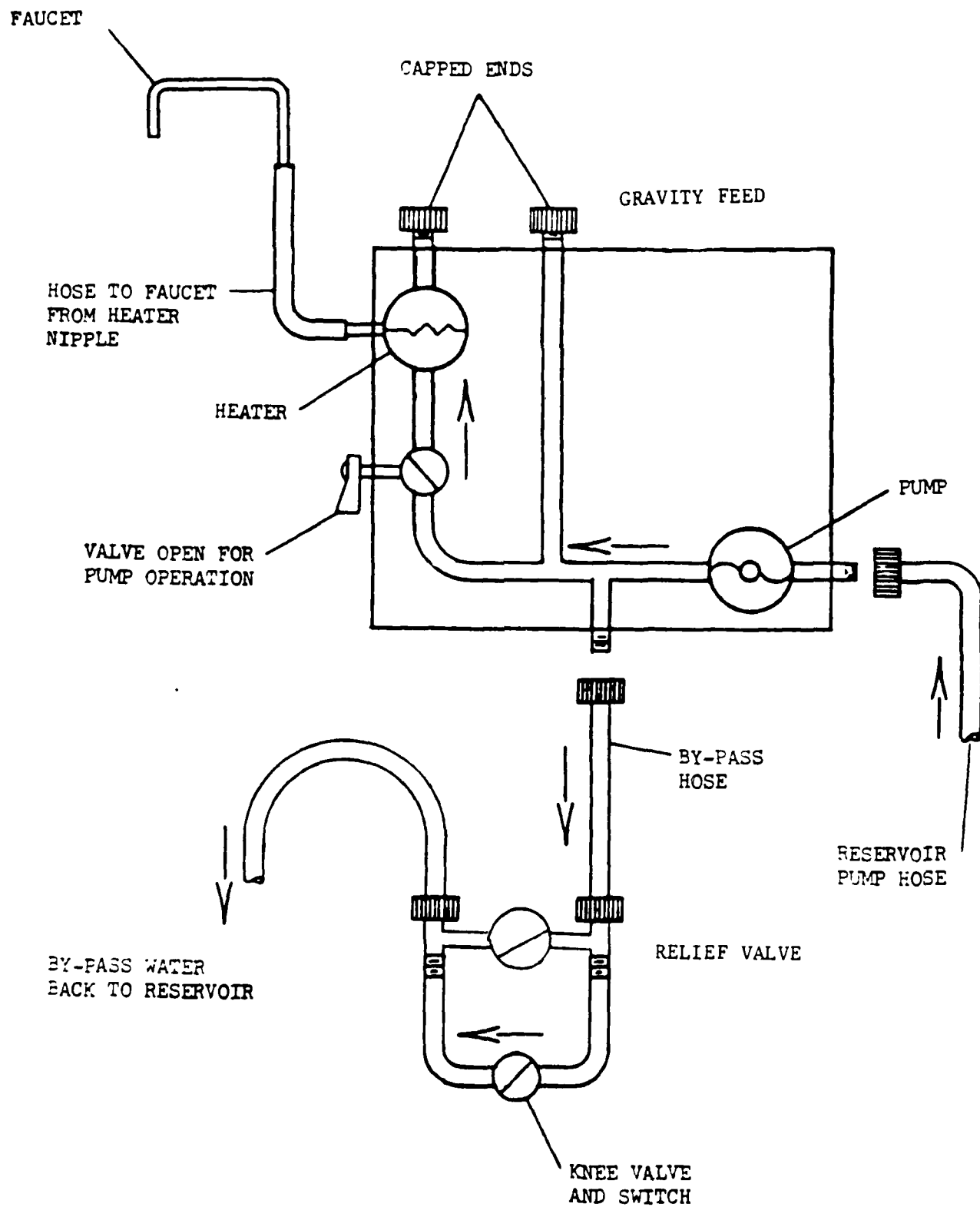


Figure 2

TESTING

The sink was operated under varied conditions. Parameters affecting operation are:

1. Flow rate of water.
2. Ambient temperature.
3. Use of relief valve.
4. Use of fan assembly.
5. Use of water heater.

Several points to be considered in the evaluation were:

1. At low flow rates, pressure does not rise enough to open valve.
2. The pump normally operates at 25-30°F above ambient temperature.
3. The pump is designed to operate efficiently at a maximum back pressure of 12 lb/in².
4. Since water temperature is a function of flow rate through the heater, pressure must be kept high enough to maintain the correct flow.

RESULTS

The first set of tests were done in a mild environment. Ambient temperature was approximately 78°F, and the water heater was not in use. Data for minimum and maximum flow rates is shown with and without use of a valve and/or extra fan.

TABLE 1. MILD ENVIRONMENT TEST

Pressure		Temp rise - Fan	Temp rise - No Fan
Min flow	2 lb/in ²	10°F	25°F
Max flow/ no valve	18 lb/in ²	20°F	45°F
Max flow	7 lb/in ²	10°F	20°F

The second series of tests were done in an environment of 107°F ambient temperature. A full reservoir of water was pumped continuously at maximum flow rate for 35 minutes. The pressure relief valve was connected and pump temperature is shown with and without fan assembly and water heater.

TABLE 2. HOT ENVIRONMENT TEST

Valve	Pressure	Temp rise - Fan	Temp rise - No Fan
Max flow/ heater	7 lb/in ²	25°F	21°F
No heater	7 lb in/ ²	19°F	23°F

In performing these tests, it was determined that fans circulating air in the environmental test chamber as part of the temperature control system might affect test results, in effect, substituting for the fan modification. To determine influence of the chamber fans, a final test was run. The chamber was heated to 105°F, shut down, and sink turned on. The sink was operated with the valve, but no fan or heater was used. Ambient temperature fell to 100°F, but the pump's thermal cutoff shut it down at 155°F.

SUMMARY AND CONCLUSIONS

In table 1, page 6, it can be seen that a minimum flow, back pressure is small, 2 lb/in², so a relief valve is not necessary. A temperature rise of 25°F is normal, so the fan is not needed to prevent the pump from overheating.

At a maximum flow without the relief valve, pressure rose to 18 lb/in² or 50 percent above maximum normal operating pressure; the corresponding temperature rise was 45°F in a mild environment.

The pressure relief valve was then installed to reduce this pressure. The maximum flow test was repeated, showing acceptable temperature rise both with and without the fan assembly. The valve was clearly needed, but it was not certain that the fan modification should be continued.

It was theorized that the pump's own fan might be adequate under mild conditions, but assistance in cooling could be required in hot environments possibly encountered in the field.

To test this theory, the sink with valve assembly was run in the environmental chamber so that ambient temperature could be raised. It is seen in table 2, page 7, that operating temperature did not vary significantly with use of the heater or fan.

It was then noted that the environmental chamber contained large fans (to assist in temperature control) that could not be turned off while the chamber was running. This additional air circulation was perhaps the reason that the extra fan did not appear to be needed.

A final test was run to answer this question. Without aid of the chamber fans, the pump overheated and failed. This shows that when air circulation in a hot room is poor, the additional fan will prevent the pump from overheating. The fan also stays on to cool the pump between uses.

While running the sink continuously for half an hour at a room temperature above 100°F is extreme, the proposed modifications will enable the sink to be reliable under adverse conditions and reduce frequency of parts replacements. For maximum capability of the scrub sink, both the fan and relief valve modifications are necessary.

RECOMMENDATIONS

1. Continue with fan assembly modification to Surgical Scrub Sink (NSN 6545-01-117-3894).
2. Add a brass pressure relief valve with cracking pressure 5 lb in² and pipe size 1/2 inch in parallel with the knee switch and valve as described in section II and figure 2, page 5.
3. Incorporate these modifications in manufacturing sinks in the future.

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